Monsanto

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March 7, 1995

VIA CERTIFIED MAIL
RETURN RECEIPT REQUESTED

Mr. Lance R. Richman, P.G.
Emergency and Remedial Response Division
U.S. Environmental Protection Agency
26 Federal Plaza, Room 13-100
New York, NY 10278

Re: Diamond Alkali Site
Passaic River Study Area

Dear Mr. Richman:

Pursuant to our letter dated February 3, 1995 regarding Monsanto's 104e response for the Diamond Alkali Site, we are hereby supplementing our response by this letter with the enclosed document, "Final Report, Evaluation of Remedial Plan Alternatives, AP/Sterox Area, Kearny Chemical Plant," dated March 11, 1985. This is in reference to Request No. 13 of the USEPA Region II Information Request dated January 4, 1995 and is marked as Exhibit D of our February 3, 1995 submission.

If you have any questions, please do not hesitate to contact me at 314/694-1278, as I will be handling the site for your future reference.

Very truly yours,

Stephen P. Krchma
Environmental Counsel

cc: Ms. Patricia C. Hick
Assistant Regional Counsel

NNR-033.sa

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FINAL REPORT
EVALUATION OF
REMEDIAL PLAN ALTERNATIVES
AP/STEROX AREA
KEARNY CHEMICAL PLANT
KEARNY, NEW JERSEY

Submitted to:

Monsanto Industrial Chemicals Co.
Kearny, New Jersey

O.H. Materials Co.

Paul D Kuhlmeier

Paul D. Kuhlmeier
Project Manager

Robert F. Weiss-Malik
Director, Client Advisory Services

March 11, 1985
Project File No. 2101

MCO 0447355

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Exhibit D

OHM

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1.0 SUMMARY

1.1 OVERVIEW

O.H. Materials Co. (OHM) has been retained by Monsanto Industrial Chemicals Co. (MONSANTO) to conduct a site investigation and to evaluate the remedial alternatives available to address the sources of Aroclor 1248/1260 (AROCLOR) within the AP/Sterox area of MONSANTO's Kearny Chemical Plant in Kearny, New Jersey.

The results of the field investigation are discussed in OHM's report entitled "Final Report, Site Investigation, AP/Sterox Area, Kearny Chemical Plant, Kearny, New Jersey" (Site Investigation Report). The site investigation report has been submitted to MONSANTO under separate cover.

The purpose of this report is to summarize OHM's evaluations of the requirements and costs associated with various remedial alternatives which may be utilized to abate the environmental problems identified at the site. The information provided in this report is based on the data and conclusions presented in OHM's Site Investigation Report.

1.2 SYNOPSIS

Our review of appropriate remedial alternatives indicates that excavation of soil contaminated with AROCLOR above 50 parts per million (ppm) and an intermediate term monitoring program may provide the most cost-effective way of acceptably addressing the identified problem. A source material is not considered a PCB material when levels are less than 50 ppm. It should be noted that we are assuming levels of AROCLOR are less than 50 ppm beneath the control building. Further exploration would be required to verify this assumption. Drilling of inclined boreholes beneath the control building and process unit would effectively address this data gap.

The following attributes are associated with a course of action OHM believes may be appropriate for remediating the current AROCLOR distribution:

- Source material is partially removed.
- Potential low-level migration is monitored periodically.
- Any potential threats to health and safety of site personnel are reduced in the long term.
- Remedial action can be completed effectively in a relatively short time frame.

- o Potential disturbance to on-going processing activities is minimized.
- o Current regulatory stance is incorporated.
- o Long-term commitments and expenditures are minimized.
- o Monitoring program is easier to administer.

2.0 REMEDIAL ACTION

Our review of appropriate remedial alternatives indicates there are several options open to MONSANTO for dealing with the sources of AROCLOR identified at the site. The purpose of this section is to provide MONSANTO with several conceptual approaches which may be applied toward remediating the PCB pollution at Kearny.

In this section, we review the objectives of a remedial action program, present potential cleanup plan components, and develop conceptual expenditure forecasts for the various cleanup components.

2.1 SUMMARY OF CONTAMINATION COMPONENTS

Based on the results of our hydrogeologic investigation of the AP/Sterox area the following site components requiring remediation can be defined:

- An area encompassing approximately 18,000 square feet, elliptic in nature having the west edge of the control building and approximately 10 feet east of the control building as foci. The focal axis of the ellipse runs in an east-west line. This area contains the highest concentrations of AROCLOR. Detectable levels were found as deep as 16 feet. It is unknown what levels of AROCLOR are present in the soil beneath the control building.

- An area of irregular shape south of the DDP recycle area. Levels of AROCLOR present are less than 900 ppm. The maximum depth of AROCLOR migration is approximately 10 feet. The total affected area is estimated to be less than 7,500 square feet.

- Ground water: Analytical testing of water quality revealed low levels of AROCLOR within the ground water. It can be theorized, based on analytical values, that the amount of soluble AROCLOR present is very small (less than 25 parts per billion [ppb]). However since water is the primary mode of transportion for contaminant migration even these low levels may be perceived as a source of continuing AROCLOR distribution.

2.2 REMEDIAL PLAN OBJECTIVES

Based on OHM's past experience with remediating similar situations and MONSANTO's goals for environmental protection, this site should incorporate measures to ensure any polychlorinated biphenyl (PCB) is dealt with in such a manner as to demonstrate:

- o Concentrated sources of PCBs are immobilized or removed.
- o Further contamination of ground water is prevented.
- o Impact on surface waters (Passaic River) and/or the environment are prevented.
- o Disruptive effects on MONSANTO's continuing operations are minimized.
- o Potential threats to the health and safety of the plant personnel and adjacent population is minimized or prevented.
- o Expenditures incurred to enact an effective remedial plan are minimized.
- o Systems requiring dedicated maintenance are minimized.

3.0 REMEDIAL PLAN ALTERNATIVES

The following sections provide a conceptual review of specific remedial alternatives for addressing the sources of PCBs identified at the AP/Sterox area. Each section discusses the construction elements, cost, and the relative advantages and disadvantages associated with each alternative. A synopsis of representative remedial plan cost is shown on Table 1.

Remedial management alternatives can be divided into five basic categories:

- o No action
- o Off-site removal
- o Containment options
- o Withdrawal, treatment, and disposal options
- o "Hybrid" options

In addition, there are potential hybrid alternatives involving conditions of the above categories. A wide range of treatment detoxification/stabilization processes, collection/withdrawal techniques, and final disposal options can be considered within each basic management alternative.

OHM's experience on past projects indicates that the comparative viability of remedial management alternatives is strongly influenced by:

- o The areal extent of AROCLOR
- o Site-specific feasibility criteria
- o Total life-cycle volume of AROCLOR treated
- o The nature and severity of potential environmental impacts

In light of the above-mentioned objectives and concerns for remediating PCB distribution the following subsections define remedial alternatives within the three major categories suitable for use at Kearny.

3.1 NO ACTION

The no-action alternative involves the monitoring and continuous reevaluation of site conditions. This alternative includes the sampling of all existing monitor wells to determine the extent and concentration of contaminants potentially emanating from the polluted zones. The wells would be analyzed for contamination on a periodic basis. This information would be assessed and reported to determine contamination conditions, and to assess temporary variations.

The primary elements of this alternative and their representative (annualized) cost includes:

o Semiannual water sampling of perimeter wells and Passaic River at dock location; analyze for AROCLOR (1248) and Priority Organic Pollutants (annualized)	$20,300
o Quarterly sampling of AP/Sterox wells; analyze for AROCLORs (annualized)	$ 3,500
o Quarterly reports (annualized)	$ 2,000

This alternative will be ineffective in dealing with the sources of contamination.

3.2 OFF-SITE REMOVAL OPTIONS

3.2.1 Open Excavation of Sources

Under this alternative, the sources of contamination would be excavated. This option involves three components:

1. Physical removal of all contaminated soils at the two defined locations
2. Demolition and reconstruction of the control building to facilitate polluted soil removal
3. Temporary dewatering of the work areas coupled with a mobile water treatment plant for effluent treatment

A staging area for additional soils dewatering by portable vacuum filtration will be prepared. The solidified material would be transported to and disposed at a secure hazardous waste landfill. Excavated areas would be backfilled with foundation grade materials.

The main elements of this alternative and their representative cost are:

o Installation of temporary dewatering system	$ 30,000
o Mobile treatment system for effluent	$ 95,000
o Vacuum filter	$ 10,000
o Preparation of staging area	$ 3,000
o Open excavation/backfill of sources	$ 87,000

- o Demolition and reconstruction control building — $ 75,000
- o Transportation to disposal site at CECOS facility at Niagara Falls, New York — $1,992,000

3.3 CONTAINMENT OPTIONS

3.3.1 Site Containment by Downgradient Drain

With this option, an interceptor drain would be installed on the downgradient side(s) of the affected areas to capture contaminated ground water migrating away from the sources. It has been established that most of the PCBs have been adsorbed on the soil matrix and appear at present to be immobile. To this end, it can be assumed that PCBs will not migrate in any quantity toward the Passiac River or migrate further downward below the peat layer. Consequently, the amount of PCBs that may become solubilized in the future may be collected in a french drain excavated to the top of the peat layer, an average of 15 feet deep. It would extend approximately 600 feet along the southwestern portion of the site. The drain will be a trench filled with coarse-grained material and wrapped with filter fabric to intercept contaminated ground water. Under this alternative, all ground water discharging from the site would be captured for treatment. A specific treatment process and size of units would be developed. The excavation would be kept open by sheet piling and sump pumps for water removal.

The main construction elements and their cost include the following:

- o Excavate 600-foot trench and backfill — $ 24,000
- o Temporary dewatering system — $ 30,000
- o Install three collection sumps — $ 13,800
- o Construction of 25-gpm dedicated treatment plant — $ 350,000
- o Yearly operation of recovery and treatment system — $1,314,000

3.3.2 Site Containment With Slurry Wall

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This alternative provides for installation of a low permeability barrier to ground-water flow. Slurry treaching is a method of constructing a subsurface barrier or slurry wall to reduce or redirect the flow of ground water. The technique was pioneered the 1940s using an oil industry derived technology (Boyes, 1975). Slurry trenching has surpassed grout curtain cut-offs and sheet piling in popularity over the past few years (D'Appolonia, 1979).

In general, slurry trenching involves excavating a trench through or under a slurry of bentonite clay and water, and then backfilling this trench with the original soil with or without slurry mixed in. Most commonly, the trench is excavated down to, and often into, an impervious layer in order to shoe off the ground-water flow. The width of trench can vary, but is typically from 2 to 5 feet (D'Appolonia, 1979).

Excavation of a trench under a bentonite slurry causes two things to happen. First, the slurry acts as shoring, supporting the trench walls to prevent cave-ins and slumping during excavation. Secondly, and most importantly, the weight of the slurry forces bentonite into the soil matrix on the trench walls and bottom. As more bentonite is forced into the soil, a filter cake is formed. The thickness of the filter cake depends on the permeability of the soil.

A slurry wall would encircle the two contaminated areas. Excavated material would be used for mixing the slurry additives and unused soil would be disposed on site. Since it has been established that the peat layer effectively impedes vertical migration of PCBs, the slurry wall would be keyed into the peat zone or silty clay layer as deemed appropriate. The depth of the walls would be 15 to 30 feet, with an estimated thickness of 30 inches. The contaminated areas would be covered with asphalt to reduce further infiltration and buildup of hydrostatic pressure. Quarterly sampling of existing monitoring wells for PCBs would be instituted for 2 years, reduced to semiannually for 3 years, and annually from thenceforth. Under this approach, contingency plans must be made to install a ground-water recovery sump and treatment system to maintain cover levels within the slurry walls. As an alternative to on-site ground-water treatment, off-site disposal should be considered.

The main elements of this alternative and the associated cost include:

o Installation of 920 linear feet of slurry wall	$ 86,900
o Installation of asphalt cover	$ 30,000
o Installation of ground-water recovery sump	$ 4,610
o Installation of dedicated ground-water treatment system or off-site disposal as applicable	$ 50,000 to $350,000
o Initial ground-water sampling (annualized)	$ 9,000

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OHM

3.3.3 Containment by Grout Curtain

This alternative parallels the theory discussed in Section 3.3.2. If differs, however, in the approach utilized in creating an impermeable barrier. Grouting is, in general, the pressure injection of one of a variety of fluids into the soil matrix to seal or strengthen it. Upon injection the fluids set into the soil voids, thereby reducing the soil permeability.

The injection process involves drilling holes to a depth of 15 feet and injecting the grout by use of special equipment. In curtain grouting, a line of holes is drilled in single, double, or triple rows (staggered) and grouting is accomplished by descending stages with increasing pressures. The spacing of the holes is determined by the penetration radius of the grout.

In general, the grouts that might be used can be subdivided into two main categories; suspension and chemical grouts. Suspension grouts are nonnewtonian fluids composed of either partly cement, bentonite, or a mixture of the two. often they are used as "pregrouts" with a second injection of chemical grout for sealing the ultrafines. A water cement ratio of 0.6 or less has proven most effective (Bowen, 1975, Tallard and Caron, 1975).

Bentonite is the most commonly used clay additive because of its size (less than 1 micron). Bentonite grouts can be injected into materials with moderate permeabilities such as fine textured sands with permeabilities around 1×10^{-3} cm/s to 1×10^{-4} cm/s (AFTES, 1975).

Chemical grouts are a more recent development than suspension grouts. Chemical grouts are true Newtonian fluids and can, depending on their nature, have very high viscosities. Because of this, they can be used to waterproof very fine soil voids. Silicate grouts are composed of a sodium silicate base, a reactant, an accelerator, and water. The reactant is typically an amide, an acid, or some polyvalent cation. A salt, such as calcium chloride is used to accelerate the set or gel of the grout. Several other types of chemical grouts are also available.

A graphic representation of this technique is presented in Figure 1.

The curtain wall would be placed around the AP/Sterox area. Monitoring of water quality would be consistent with the option presented in Section 3.3.2.

Major components and costs of this option are:

o Injection of chemical/clay grout	$1,218,000
o Asphalt pavement over process area	$ 30,000
o Water-quality monitoring program (annualized)	$ 9,000
o Installation of ground-water recovery sump	$ 4,610
o Installation of dedicated ground-water treatment system or off-site disposal as applicable	$ 50,000 to $ 350,000

3.4 WITHDRAWAL, TREATMENT, AND DISPOSAL OPTIONS

3.4.1 Containment by Dedicated Pumping/Flushing System

This selection considers the use of a series of extraction and injection wells that will allow water within the contaminated zone to be pumped, treated, and pumped back into the aquifer. Plume containment by pumping is an effective means of preventing the eventual pollution of the Passaic River that is hydraulically connected to the contaminated ground water.

Theory behind containing a plume by pumping is based on incorporating the plume within the radius of influence of an extraction well. Figure 2 illustrates how the injection well affects the drawdown and radius of influence.

The size of wells to be installed is governed by the flow rate of water to be removed and the height the water is to be lifted. Pumping rates less than 100 gpm and less than 25 feet of pumping head can be handled by a 4-inch pump. Combinations of head and flow rate in excess of these values generally require a 6-inch pump. It is anticipated that ultimately 25 gpm will be removed and injected.

It is envisioned that pumping wells would be placed in each of the contaminated zones along with recovery wells placed upgradient of each zone for ground-water replacement.

Primary components of this system and the associated cost are:

o Installation of wells, pumps, and related piping	$ 14,100
o Operation and maintenance of well system (annualized)	$ 58,000

- o Construction of a 25-gpm dedicated treatment plant — $ 350,000
- o Operation and maintenance of recovery and treatment system (annualized) — $1,314,000

3.4.2 Containment With Downgradient Inteceptor Wells

Under this alternative, recovery wells would be installed downgradient of the AP/Sterox area. The wells would be located in a line in the same location as the french drain described in Section 3.3.

The system consists of a group of closely spaced wells connected by a header pipe and pumped by suction centrifugal pumps or jet ejector pumps. A pump may be connected to one well point or a central pump may be used for the entire well point system. The drawdown from the system at any point in time is directly proportional to the pumping rate and inversely proportional to aquifer transmissivity and storativity.

Since the water table at Kearny is shallow and drawdown requirements are minimal, a well-point system using a centrifugal suction pump located at the center of the header is suitable. Theoretically, the maximum suction lift obtainable from suction pumps is about 20 to 25 feet, but friction losses reduce this to 15 to 18 feet (Johnson Division, 1975). For the sandy silts present, well points with a diameter of 1.5 inches are generally satisfactory. Concurrently, 1-inch riser pipes might be appropriate for this case.

Well-point spacing is based on the radius of influence of each well and the composite radii of influence needed to lower the water table. Well points are usually spaced 2 to 6 feet apart, depending on the permeability of the water-bearing materials and the depth the water table is to be lowered. Figure 3 illustrates the well point technique.

Well points are made to be driven in place, to be jetted down, or installed in open holes. The most common practice is to jet the well points down to the desired depth, flush out the fines, leaving the coarser fraction to collect in the bottom of the hole, then the point is driven into the coarser materials. Ground water recovered would be routed to appropriate treatment and discharged. A minimum water-quality monitoring program consisting of analysis of seven area well waters seminannually for PCBs would be included.

The primary construction elements of this alternative and their representative cost includes the following:

o Installation of wells, pumps, and related piping	$ 85,300
o Construction of a 25-gpm dedicated treatment plant	$ 350,000
o Operation and maintenance of well system (annualized)	$ 58,000
o Operation of recovery treatment system (annualized)	$1,314,000
o Ground-water monitoring program	$ 4,500

3.5 HYBRID OPTIONS

3.5.1 Excavation of Gross Contamination and Containment With Slurry Wall

Under this approach, soils containing PCB levels above 100 ppm will be excavated and transported off site to a secure repository. It is estimated that between 500 and 1,500 cubic yards (cy) would be excavated and removed. For the greater part, grossly contaminated soils are found in the upper 4 to 5 feet of the soil profile. In conjunction, a slurry wall would be placed around the two defined areas of contamination to ensure the immobility of the remaining constituents. Its construction would be consistent with the technique described in Section 3.3.2. This approach would allow for the removal of the major contamination of PCB at Kearny without requiring an extensive construction effort. Provisions for underpinning structures, if, in fact, soils beneath them are above the target level, have not been considered, and, for practicality, OHM would recommend leaving the soils in place. In addition, semiannual water-quality analyses for PCBs within seven area wells would be recommended.

The primary construction components and related costs of this alternative would be:

o Installation of 920 linear feet of slurry wall	$ 86,900
o Installation of asphalt cover	$ 30,000
o Temporary dewatering and mobile treatment system for excavation phase	$125,000
o Excavation/backfill of 1,000 cy of soil	$ 14,500

- o Vacuum filtration of excavated soils — $ 10,000
- o Transportation to disposal site at CECOS facility in Niagara Falls, New York — $332,000
- o Ground-water monitoring (annualized) — $ 4,600

3.5.2 Excavation of Gross Contamination, Containment by Slurry Wall, and Secondary PCB Removal by Flushing

This option differs from the alternative presented in Subsection 3.4.2 in that PCB contamination remaining after excavation would be physically removed by injecting clean water into the soil formation at one location and removing contaminated water from the opposite end. At all times a water balance would be maintained as to prevent an induced pressure gradient across the slurry wall.

A four-step approach would be carried out. Soils containing PCB levels above 100 ppm would be excavated and removed off site. An injection well and pumping well would be installed at each of the two contaminated areas. The wells would be completed prior to excavation in order to function as a temporary dewatering system and subsequently as a flushing system. The third step would be the installation of the slurry wall system as described in Section 3.3.2. Finally, the wells would be connected to a dedicated treatment system where treated water would be reinjected into the ground water creating a closed-loop system.

Major components of this system and their associated costs are:

- o Installation of wells, associated pumps, and related piping — $ 14,100
- o Excavation/backfill of 1,000 cy of soil — $ 14,500
- o Vacuum filtration of excavated soils — $ 10,000
- o Transportation to disposal site at CECOS facility in Niagara Falls, New York — $ 332,000
- o Construction of a 25-gpm dedicated treatment plant — $ 350,000
- o Operation and maintenance of well system (annualized) — $ 58,000
- o Operation and maintenance of recovery treatment system (annualized) — $1,314,000

3.5.3 Excavation of Gross Contamination and Dedicated Monitoring

Under this alternative, soils containing over 100 ppm of PCB would be excavated, dewatered, and removed off site. Excavated areas would be backfilled with structural-grade clean fill. In conjunction, a water-quality monitoring program would be developed to ensure that PCBs are not migrating off site. It is estimated that semiannual sampling of the newly installed wells along with Wells 3, 5, 7, and 8 for PCBs would be sufficient.

Excavation with this plan would be limited to the upper 6 feet of soil and probably would not require excavation beneath the control building. Approximately 500 to 1,500 cy of soil would be removed under this plan. There would be no maintenance per se and sampling would be limited to PCBs only.

The primary elements of this alternative include:

o Excavation/backfill of 1,000 cy of soil	$ 14,500
o Temporary dewatering and mobile treatment system for excavation phase	$125,000
o Vacuum filtration of excavated soils	$ 10,000
o Semiannual well sampling for PCBs	$ 4,600
o Transportation to disposal site at CECOS facility in Niagara Falls, New York	$332,000

4.0 EVALUATION OF ALTERNATIVES

4.1 OVERVIEW

The various remediation options identified in the preceding section can be divided into three conceptual alternatives to address problems identified at the site:

- o No-action alternatives
- o Source-removal alternatives
- o Site-containment alternatives

The advantages and disadvantages of each of the conceptual approaches and varying nuances available to each type of system are highly dependent on MONSANTO's posture toward the site environmental quality. A listing of remedial plan attributes is presented in Table 2.

The higher costs associated with complete removal of the soil containing PCBs versus some degree of containment are self-evident. In addition, there may be significant disruption of plant processing while complete source removal is underway. However, the disruption would be relatively short term, costs would be defined and finite, and the present condition would be remedied.

OHM believes the AROCLOR can be effectively immobilized within its present location. The initial costs associated with site containment are generally lower. Depending on the selected alternative, significant maintenance could be required for an unspecified amount of time. A containment system involving minimal maintenance was also offered, but the AROCLOR-laden soil would remain on site.

At OHM, we do not endorse any particular remedial method or environmental quality posture. It is our intention to provide a wide range of viable solutions as we have done here. The relative worth of these remediation techniques is left solely up to MONSANTO.

4.2 NO-ACTION ALTERNATIVE

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Under this alternative, the construction elements are limited to the monitoring of existing on-site wells. The cost associated with this program is understandably low in comparison to other approaches.

This alternative does not provide any resolution to the identified contamination at Kearny. It is based on the assumption that the contaminant levels are acceptably low and are expected to remain in their present location for time immemorial. This approach can be implemented within a minimal time frame (weeks); however, the execution time frame is indefinite.

Accepting the no-action scenario does not provide any specific safeguards for protection of public health and safety and, except for the on-going monitoring of contamination and subsequent reports to a regulatory agency, this alternative is of questionable feasibility due to current regulatory practice. In addition, a more costly remedial program could be expected to result if source abatement is required in the future.

4.3 SOURCE-REMOVAL ALTERNATIVES

The concept of removing the contaminated soil from the site is presented in four alternatives with varying nuances. The initial capital expenditures for excavation of soils is the highest of the various alternatives.

Excavation of all the affected soil does provide the most cost-effective method of remediating the problem. It requires a one-time expense and requires no long-term maintenance or observation. This alternative provides the best health and safety safeguards for the adjacent population after the source is removed.

Source-removal alternatives are the most effective for regulatory acceptance and closure requirements. Removal of any portion less than whole will still leave the potential for future litigation given rapidly changing environmental policies.

Finally, excavation of all contaminated soil would probably lead to substantial interference with on-going plant operations. At minimum, it would require the demolition and reconstruction of the control building in the AP/Sterox area.

All of the three partial excavation plans offer reduced disturbance to on-going operations. Their initial outlay of capital is less and they also meet requirements often sought by regulatory agencies. The primary drawback of partial excavation alternatives is the long-term monitoring commitment and the fact that at least some of the contaminant source still remains.

4.4 SITE-CONTAINMENT ALTERNATIVES

Under this approach, the construction elements require different initial expenditures for the construction phase and are coupled with various supplemental treatment requirements. Seven of the ten alternate methods of addressing the PCB contamination utilize source containment in some form.

Installation of a bentonite slurry wall provides the lowest initial capital investment. Depending on regulatory stance, annual expenditures for this method could vary greatly. Dedicated pumping/flushing and installation of a downgradient drain provide the next two lowest initial expenditures. On-going treatment costs for the drain option tend to preclude it as a viable alternative.

The site-containment method can be implemented in a moderate time frame. The execution period, however, is indefinite due to the continued potential migration of contaminants in the ground water.

The control of contaminants migrating through the ground water will minimize future health and safety concerns for adjacent population. This conceptual approach is of high feasibility and the degree of risk is low to moderate due to the apparent substantial attenuation of PCBs onto the soil matrix. A moderate regulatory stance can be expected due to the low potential for migration and secondary assurances by use of monitoring.

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TABLES

TABLE 1

SUMMARY OF ESTIMATED COSTS

POTENTIAL REMEDIAL ALTERNATIVES

	Alternative	Base Cost: Construction	Base Cost: Yearly Operation	Accumulative Projected Cost: 1 Year	Accumulative Projected Cost: * 5 Years	Accumulative Projected Cost: * 10 Years
1.	No Action	-0-	25,800	25,800	142,570	324,500
2.	Open Excavation of Sources	2,292,000	-0-	2,292,000	2,292,000	2,292,000
3.	Downgradient Drain	417,800	1,314,000	1,731,800	7,678,900	16,945,300
4.	Slurry Wall	171,500+	9,000	180,500	221,200	284,700
5.	Grout Curtain	1,302,600+	9,000	1,311,600	1,352,300	1,415,800
6.	Dedicated Pumping/Flushing	364,100	1,372,000	1,736,100	7,945,800	17,621,100
7.	Downgradient Interceptor Wells	435,300	1,376,500	1,811,800	8,041,800	17,748,900
8.	Partial Excavation/Slurry Wall	598,400	4,600	603,000	626,300	663,700
9.	Partial Excavation/Slurry Wall/ Pumping and Flushing	720,600	1,372,000	2,092,600	8,302,300	17,977,600
10.	Partial Excavation/Monitoring + Includes French Drain to Collect Product Layer	481,500	4,600	486,100	506,900	539,400

+ minimum expected value
* assumes 5% average inflation rate overtime

TABLE 2

SUMMARY OF REMEDIAL PLAN ATTRIBUTES

(Conceptual) (Alternative)	Advantages	Disadvantages	Strategy
1. No Action	- Easy to implement - Low capital investment - Low annual costs	- Does not address status quo - May require additional wells - Potential for contaminant migration	- Source not removed - Regulatory stance - Personnel considerations
2. Source Removal	- Removes sources - Eliminates potential for contaminant release - Ground-water improvement with time - No continuing financial requirements	- Potential liability - High initial capital investment - Plant process disturbance probable	- Health and Safety - Source removed off site - Disposal site limitations - Plant disturbance
3. Source Containment	- Provides source control - Addresses potential ground-water plume - Prevents off-site contaminant migration - Lower initial capital expense	- Perpetual operation and maintenance - Plant process disturbance probable (less than No. 2) - Long-term commitment to site monitoring - Long-term financial commitment	- Source not removed - Long-term commitment - Personnel considerations

FIGURES

4851

DRAWN BY	CEM	CHECKED BY/DATE			REVISIONS	BY	DATE	DRAWING NO.
DATE	12/28/84	APPROVED BY/DATE						2101 A-748-G

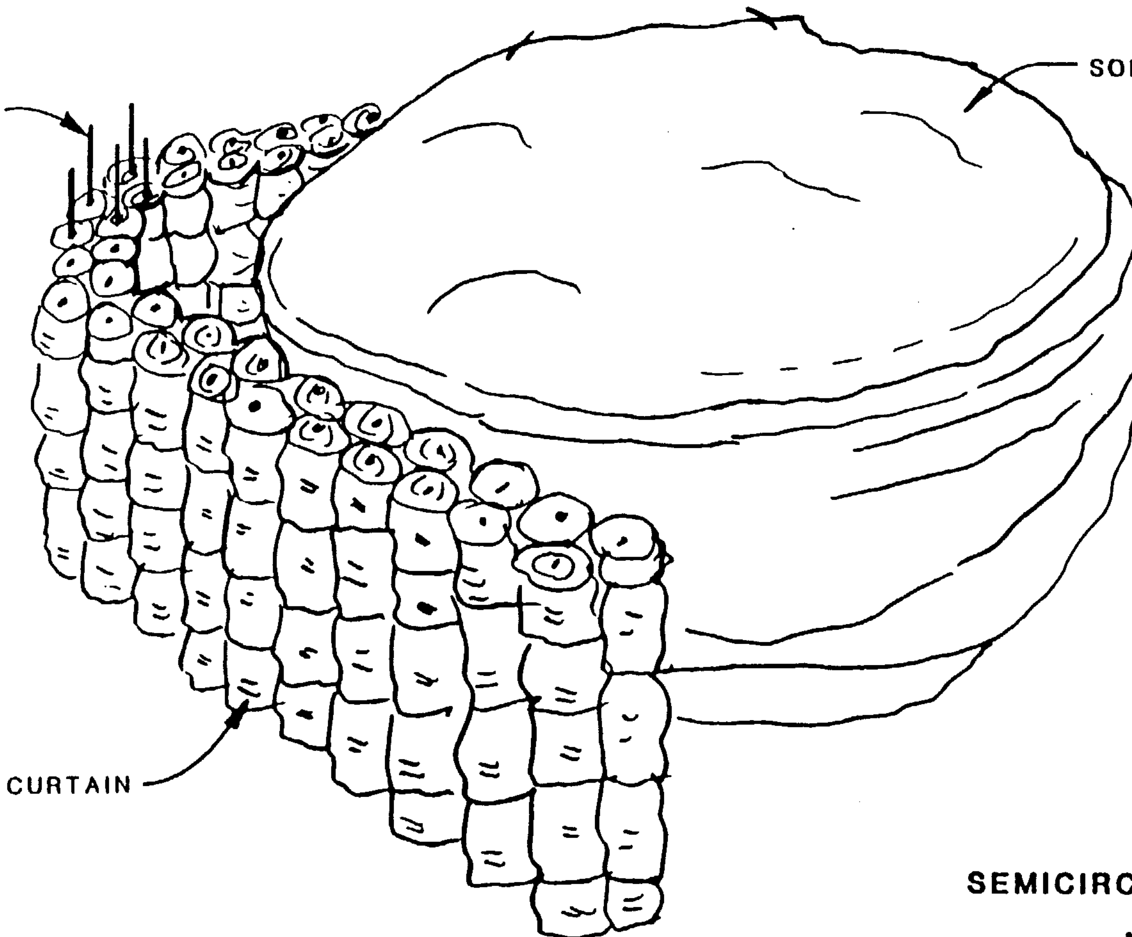

FIGURE 1

SEMICIRCULAR GROUT CURTAIN

MONSANTO

KEARNY CHEMICAL PLANT

KEARNY, NJ

PREPARED FOR:

MONSANTO

KEARNY, NJ

85011002B

MCO 0447361

N48519

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DATE	12/28/84	APPROVED BY/DATE						2101 A-748-E

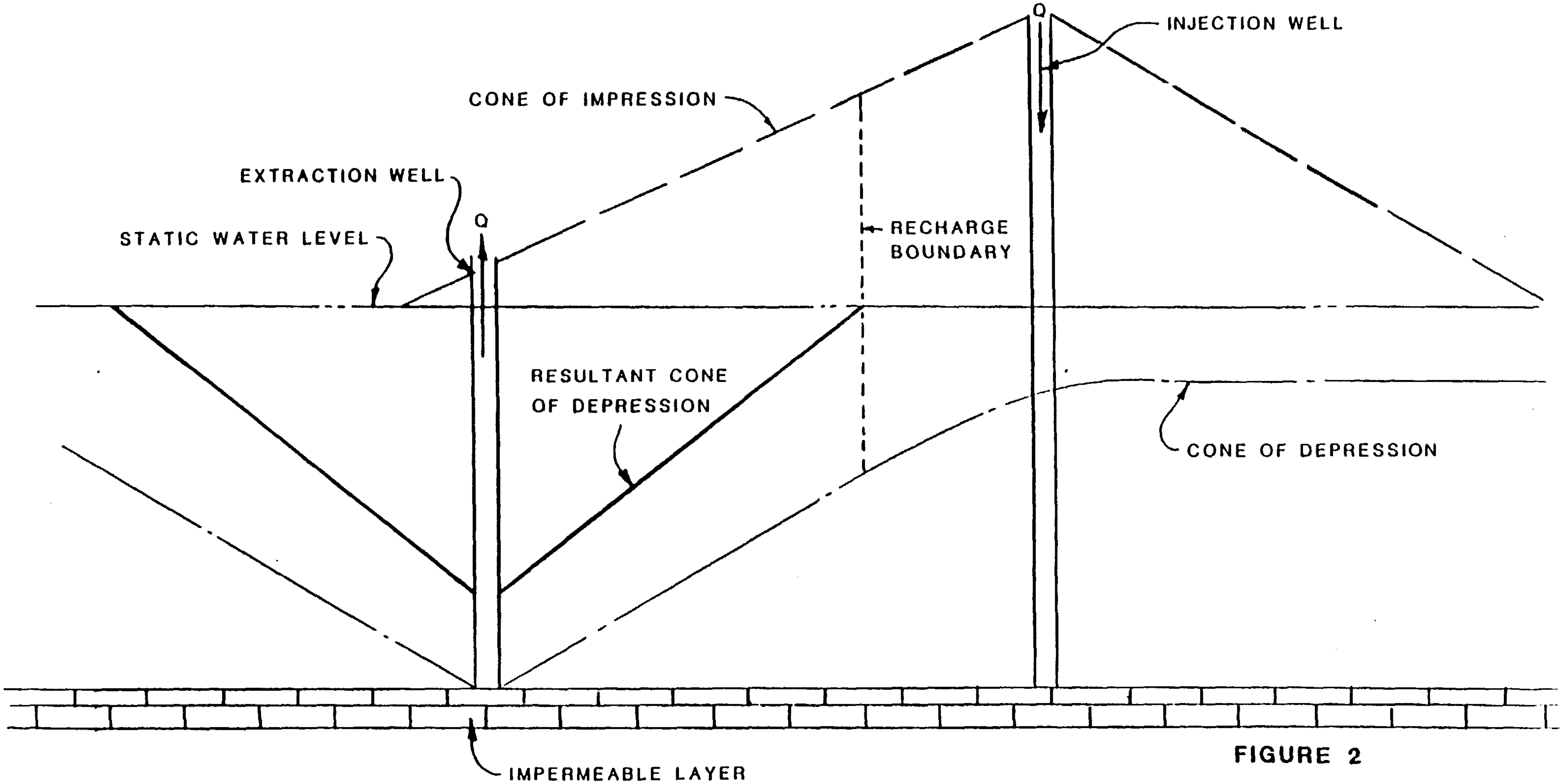

FIGURE 2

EFFECT OF INJECTION WELL
ON CONE OF DEPRESSION
MONSANTO
KEARNY CHEMICAL PLANT
KEARNY, NJ

PREPARED FOR:
MONSANTO

KEARNY, NJ

MCO 0447382

850110029

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DATE	12/28/84	APPROVED BY/DATE						2101 A-748-F

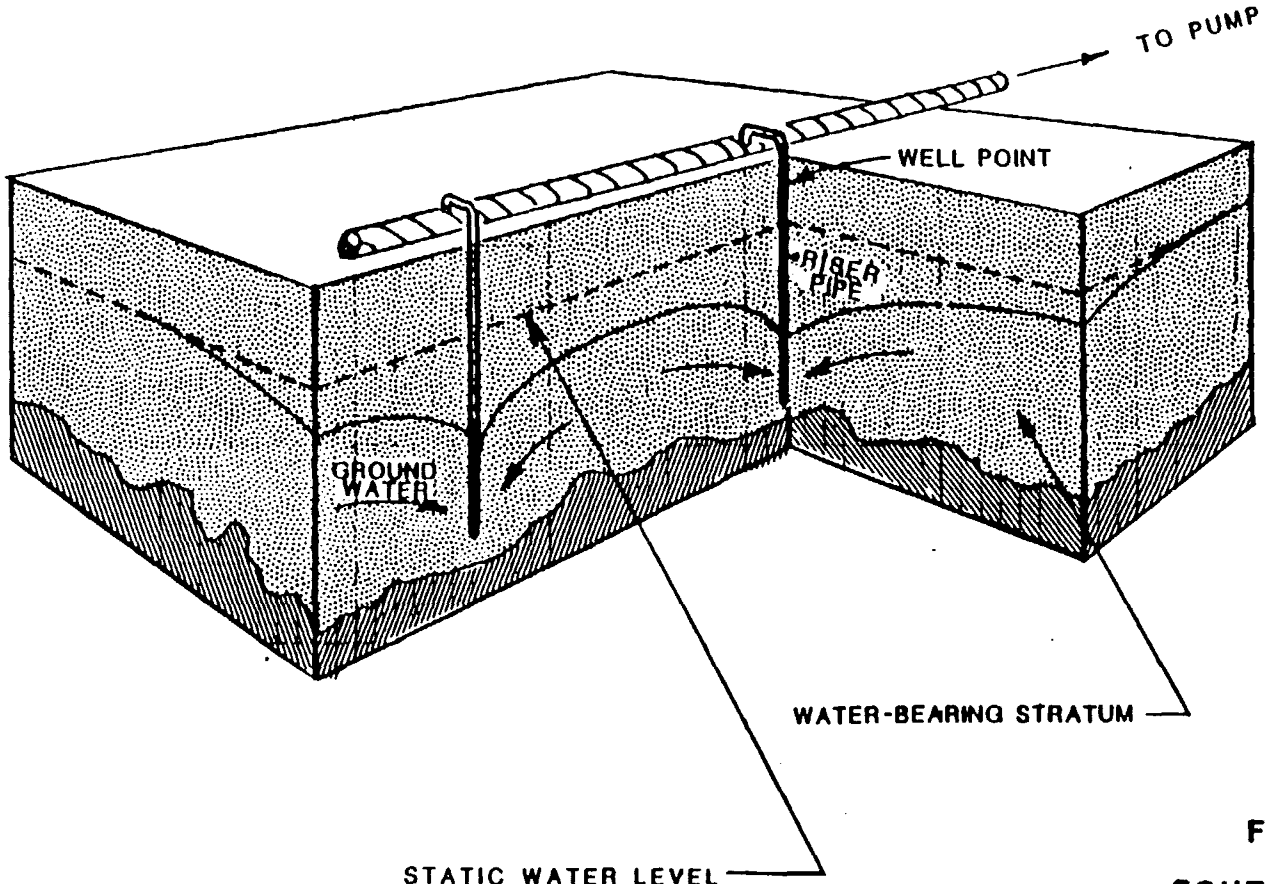

FIGURE 3

SCHEMATIC OF A WELL POINT DEWATERING SYSTEM
MONSANTO
KEARNY CHEMICAL PLANT
KEARNY, NJ

PREPARED FOR:
MONSANTO,

KEARNY, NJ

APPENDIX A

SUMMARY OF ESTIMATING ASSUMPTIONS

SUMMARY OF ESTIMATING ASSUMPTIONS

Element and Assumption	Per Unit Estimate
1. Sampling of Wells	$ 1,000.00
o 1-day sampling trip	
2. Analysis of water samples, each	$ 1,310.00
o Analyses for volatile organics and metals $1,200	
o Analyses for PCBs $110	
3. Monitoring reports, each	$ 500.00
4. Excavation and installation of drain, per lineal foot	$ 40.00
o 15 feet deep, 2.5 feet wide o Backfilled with select gravel o Wrapped with filter fabric	
5. Collection sumps, per sump	$ 4,610.00
o 48-inch concrete manhole and cover, $1,175 each	
o Pumps and switches, $1,435 each	
o Piping and installation, $2,000 each	
6. Construction of on-site dedicated treatment plant	$ 350,000.00
o Design capacity 25 gpm	
o System components: phase separator, rapid-mix tank, clarifier, gravity thickner, multimedia filter, carbon adsorption cell, finishing pool	
7. Treatment system operation, per gallon	$ 0.10
o Includes: maintenance labor, operations labor, chemicals, disposal of residuals, and maintenance of small recovery systems	

8. Mobile treatment system operation, per gallon — $ 0.20

   - Includes: maintenance labor, operations labor, chemicals, disposal of residuals, and maintenance of small recovery systems

9. Installation of slurry wall, per square foot (sq ft) — $ 6.30

   - Bentonite/soil construction
   - Equipment mobilization: backhoe, dozer, slurry mixer, etc., $1 per sq ft
   - Slurry trenching, excavation, mixing, backfill, $5 per sq ft
   - Using cement as additive, add $.30 per sq ft

10. Installation of grout curtain, per cy — $ 145.00

   - Mixing, drilling, chemicals, pumps, manifolds, etc., (in place), per cy

11. Installation of asphalt cover, per sq yd — $ 27.00

   - Includes grading, compaction, and placement

12. Interceptor Well Point System (incremental)

   - A 6-inch header pipe, per lineal foot — $ 35.00
   - A 2-inch - 15-foot deep well point, per lineal foot — $ 22.60
   - Fittings, per well point each — $ 15.00
   - Centrifugal suction pump, each — $ 1,800.00

13. Interceptor wells system, per well

- o Drilling and installation of 4-inch diameter, PVC wells, 15-feet deep, per lineal foot — $ 40.00
- o Submersible pumps and switches, each — $ 800.00
- o Piping: materials and installation, each — $ 375.00

14. Operation and Maintainence (well points or wells), annual — $ 58,000.00

- o Labor (operation and maintenance) $45,000/year
- o Materials, pump/well replacement @ 18 percent threshold capacity for breakdown, $13,000/year

15. Excavation of Contaminated Soil, per cy — $ 14.50

- o Excavation of hazardous soils, per cy, $10.50
- o Backfilling excavated areas, per cy, $4.00

16. Temporary dewatering system — $ 30,000.00

- o Wells, 14 feet deep, $40/ft installed
- o Pumps, submersible, $800 each
- o Fittings, $15/well
- o Electricals/piping, $375/well
- o Header pipe, $35/ft

17. Contaminated Soils Dewatering (past excavation) and Sludge Thickening, Lump sum — $ 10,000.00

- o Fly ash for solidification
- o Increase in soils volume by 25 percent to allow for bulking
- o Physical mixing of additives and soil

18.	Transportation/disposal at CECOS Facility, Niagara Falls, New York, per cy	$	266.00

- o Transportation cost, per cy, $80
- o Disposal cost, per cy, $186

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18.	Transportation/disposal at CECOS Facility, Niagara Falls, New York, per cy	$ 266.00

- o Transportation cost, per cy, $80
- o Disposal cost, per cy, $186

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